

## Introduction

- ❖ Development of human body begins with a series of cell division , multiplication & differentiation into various structures
- ❖ A **failure** or **disturbance** that occurs during these processes may result in a lack ,excess or deformity of a body part
- ❖ These are called developmental disorders , developmental anomalies , abnormalities or disturbances

## Developmental disturbances of teeth

- ❖ **Abnormalities of morphodifferentiation** : abnormalities in the differentiation of dental lamina & tooth germs causes abnormalities in the number , size ,and form of teeth
- ❖ **Abnormalities of histodifferentiation** : abnormalities in the formation of the dental hard structure resulting in disturbances in tooth structure

### Disturbances may be :

**Hereditary {genetics }**

**Acquired {environmental }**

## ❖ Abnormalities of morphodifferentiation

### I-Disturbances in number of teeth

- **Total anodontia** :total failure of development of a complete dentition {extremely rare}
- **Partial anodontia {hypodontia}** :failure of development of one or more teeth {relatively common and often hereditary} the teeth most frequently missing are third molars , permanent maxillary lateral incisors , & mandibular 2nd premolar



- **Hypodontia or anodontia associated with systemic defects**
  - 1) Hereditary hypohidrotic ectodermal dysplasia
  - 2) Down syndrome :missing third molars

## Hereditary hypohidrotic ectodermal dysplasia

- ❖ Characterized by congenital loss of **ectodermal structures**
- ❖ Hypodontia
- ❖ Inability to sweat due to absence of sweat glands {**anhidrosis**}
- ❖ Smooth, shiny and dry skin
- ❖ Scanty hair {**hypotrichosis**}
- ❖ Defective finger nails

Sex linked recessive trait



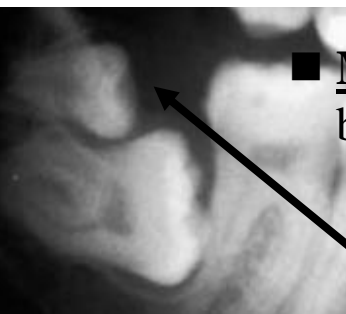
## Hyperdontia

- Additional teeth {relatively common}
- These are the result of excessive but organized growth of the dental lamina {unknown cause}
- ❖ **Supplemental teeth** : extra teeth that morphologically resemble normal teeth {maxillary lateral incisor, premolars & 4th molar}
- ❖ **Supernumerary teeth** : extra teeth that morphologically differ from normal teeth {conical or peg shaped}

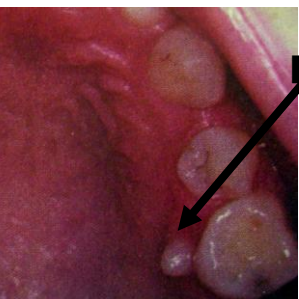
Several terms have been used to describe supernumerary teeth depending on their location



- Mesiodens : a supernumerary tooth in the midline between the maxillary central incisors



- Distomolars: an accessory fourth molar



- Paramolar : a posterior supernumerary tooth situated lingually or buccally to a molar



- **Natal teeth** : accessory teeth that may be present at birth
- **Neonatal teeth** : are those arising within 30 days of life
- **Dental transposition** : when normal teeth erupt into an inappropriate position {e.g. canine between two premolars }
- ❖ Supernumerary teeth may **prevent the eruption** or cause **malposition** or **resorption** of adjacent teeth , and may develop **dentigerous cysts**

DropBooks

## II-Developmental alteration in the size

- Tooth size is variable among different races and between sexes
- ❖ **Macrodontia** : teeth larger than average {i.e. physically larger than normal }
- ❖ **Microdontia** : unusual small teeth { i.e. physically smaller than usual }
- **Generalized Macrodontia** has been noted in association with:
  - 1 . **Pituitary gigantism**
  2. **Facial hemihypertrophy**
- **Generalized Microdontia** has been noted in association with :
  1. **Pituitary dwarfism**
  2. **Down syndrome**
- ❖ **Macrodontia** affecting single tooth is uncommon
- ❖ **Microdontia** involving a single tooth is more common than generalized microdontia

## Most commonly affected teeth {microdontia }

1. Maxillary lateral incisors
2. Third molars



- The maxillary lateral incisor **appear as** :

**Peg shaped** crowns overlying a normal root length  
**The mesiodistal** diameter is reduced &  
**The proximal surfaces** converge towards the incisal edge

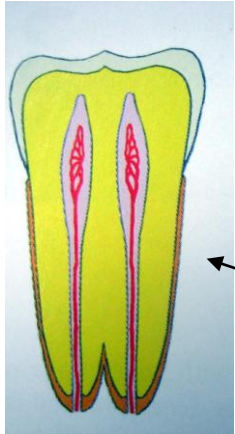
- The maxillary molar **appears** small but normally shaped



**NB.** Both **maxillary lateral incisors** and **third molars** are among the most common teeth to be congenitally **missing**

## II-Developmental alterations in the shape of teeth

### Fusion , gemination , concrecence :



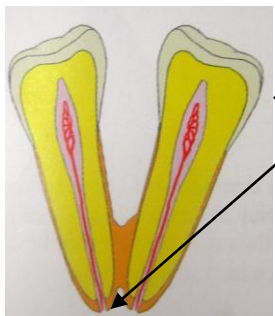
Terms used for teeth joined together based on the suspected aetiology

❖ **Fusion** : **union** between the dentine & or the enamel of **two** separate developing teeth

❖ **Gemination** : partial development of two teeth from a **single** tooth bud following incomplete division



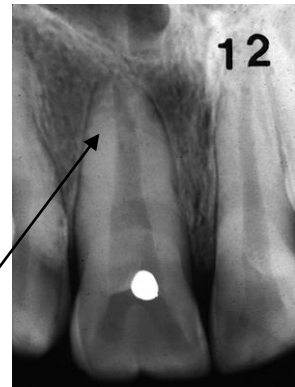
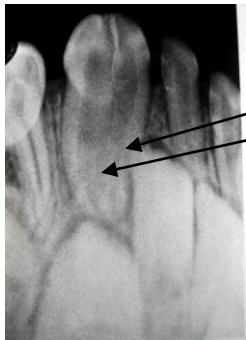
❖ **Concrecence** : it is the **union** of two teeth by **cementum** it is **not** a *developmental anomaly it occurs after root development* **caused by** trauma or adjacent tooth malposition & crowding of teeth



■ **Distinction** between gemination and fusion is made by counting the number of teeth in the dentition

■ **In case of fusion** their **number is decreased** by one as two teeth are replaced by one single abnormally formed fusion product {unless ? }

■ **In case of gemination** , the **number is normal** but with one of the teeth being replaced by an abnormally formed one

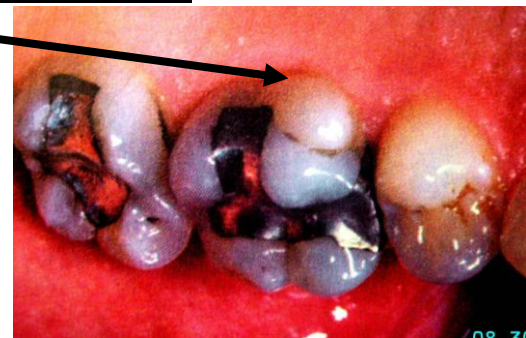




## Accessory cusps

Three different patterns are recognized

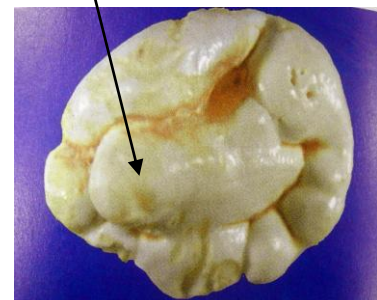
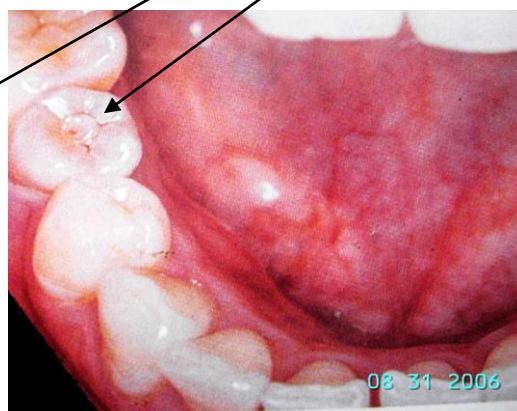
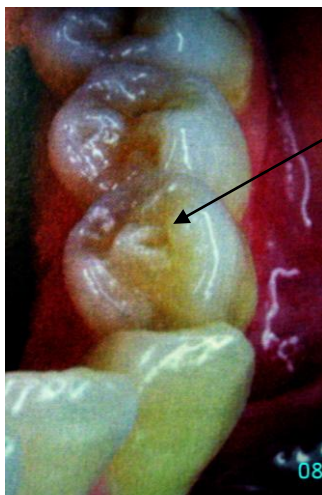
- **Cusp of Carabelli** : located on the palatal surface of the mesiolingual cusp of a maxillary molar



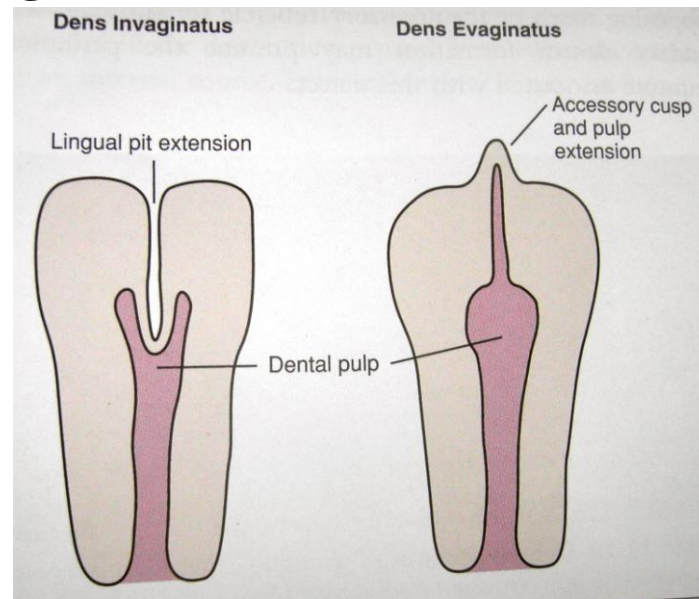
- **Talon cusp {dens evaginatus of anterior teeth}** : located on the lingual aspect of anterior teeth which resembles an eagle talon



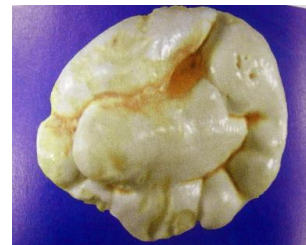
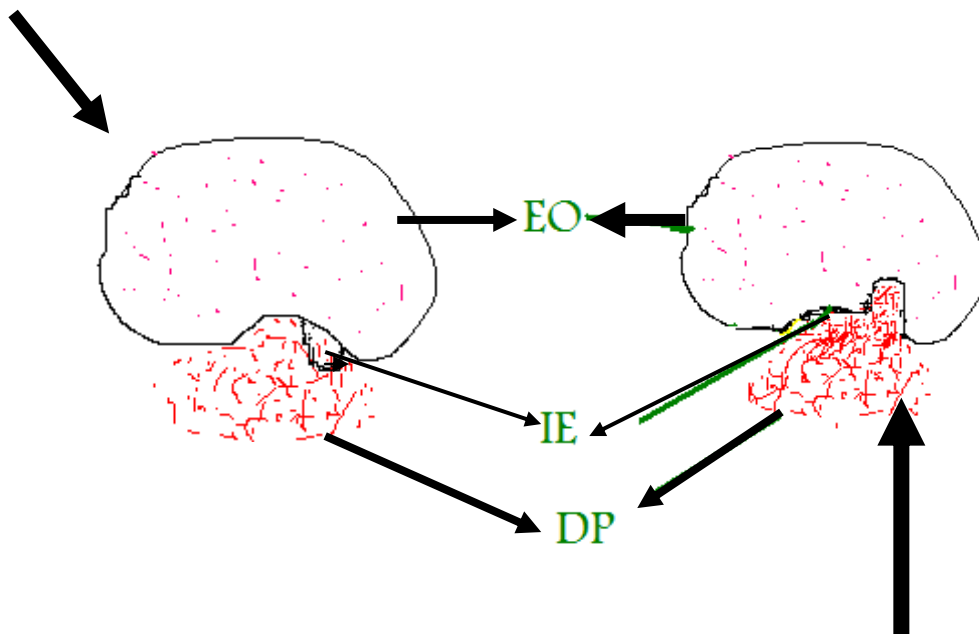
- **Dense evaginatus {central tubercle}** an accessory cusp on the occlusal surface between the buccal & lingual cusps of permanent **premolars or molars**



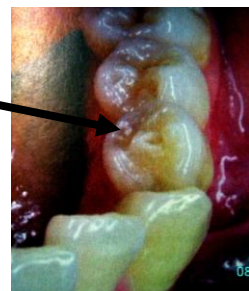
## Dens Invaginatus {dens in dente} & Dens Evaginatus



**Dens invaginatus {dens in dente}**: due to invagination of an area of the inner enamel epithelium into the dental papillae during odontogenesis resulting in the formation of **enamel lined cavity** which communicates with the surface

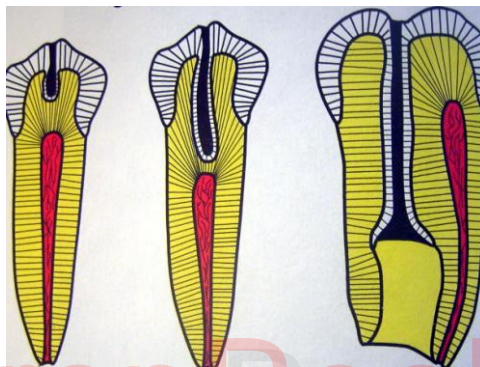


**Dens evaginatus** : due to proliferation & **evagination** of an area of inner epithelium and adjacent odontogenic mesenchyme during development



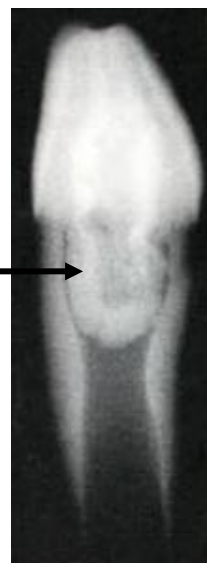
## Dens invaginatus {dens in dente}

- The depth of invagination varies from a slight enlargement of the cingulum pit {i.e. exaggeration of the cingulum pit} to a deep infolding that extends to the apex



- In the interior of the tooth, the pit dilates to form a large cavity
- Through this pit, bacteria from the oral cavity have free access to the inner part of the tooth which makes it vulnerable for carious decay

- ❖ When dentine & enamel forming tissue invaginate the whole length of a tooth {e.i. when invagination is large} it appears radiographically as a tooth within a tooth { dens in dente }





### Enamel pearl or enameloma {ectopic enamel}

- A small **nodule of enamel** formed on the root surface near the amelocemental junction , on **maxillary molars** at the furcation area
- This may result from cells of **Hertwig's sheath** which have become differentiated into ameloblast
- Occasionally containing minute horn of small pulp



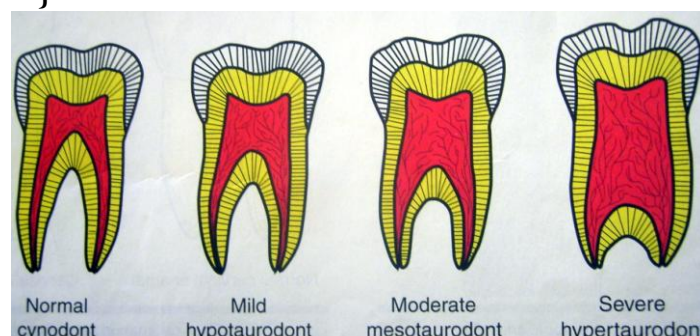
### Taurodontism {bull like tooth}

- **Elongated crowns** or **apically displaced furcation** {i.e. tends to be rectangular}
- **Pulp chamber** shows increased apico-occlusal height
- This condition is **due** to failure of epithelial root sheath of Hertwig's to invaginate at the proper horizontal level

The **degree of taurodontism** has been classified into :

1. Mild {hypotaurodontism}
2. Moderate {mesotaurodontism}
3. Severe {hypertaurodontism}

**According** to the degree of apical displacement of the pulpal floor



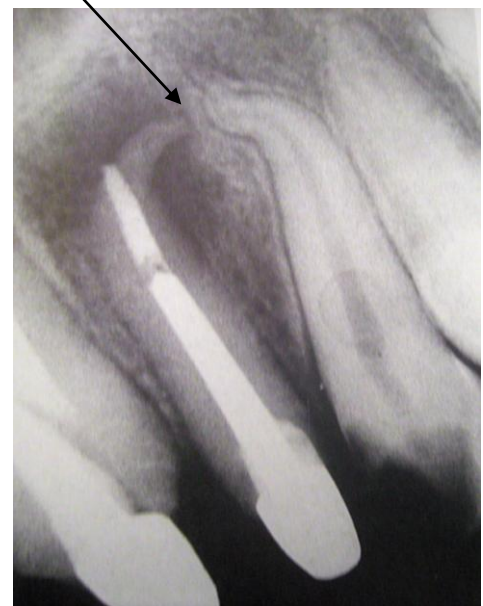


## Dilaceration

- Abnormal angulation or bend in the root
- The most commonly affected teeth are the maxillary central incisors

**The cause** : **trauma** during root development

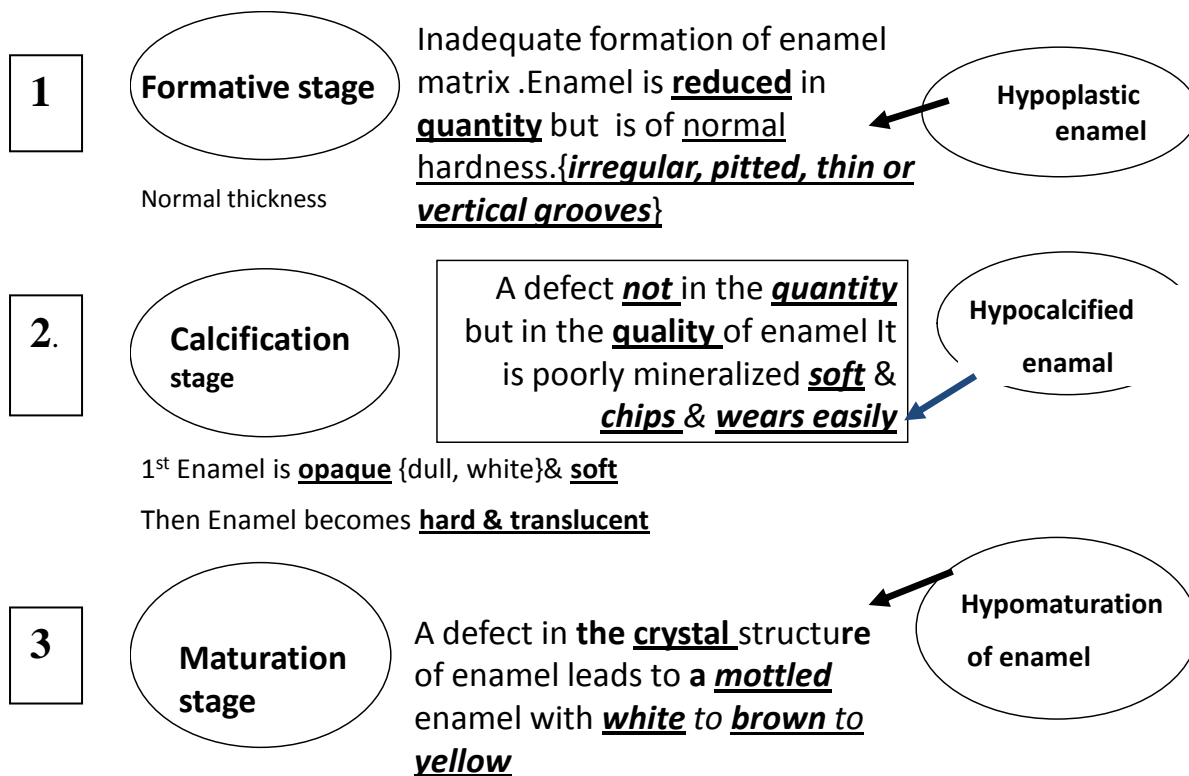
- Movement of the crown & part of the root {i.e. calcified part} from the remaining developing root {i.e. not yet calcified} may result in sharp angulation after the tooth completes development
- Extraction & root canal filling is challenging



## ❖ Abnormalities of histodifferentiation Disturbances in tooth structures

### Normal enamel is formed in 3 stages

- 1. **Formative stage** :ameloblasts deposit organic matrix → normal thickness of enamel
- 2. **Calcification stage** : mineralization of enamel matrix by formation of crystals & removal of the majority of the original proteins
- 3. **Maturation stage** : crystals enlarge & mature {remnants of original proteins are removed }



## Amelogenesis imperfecta

- It is a **genetically** determined defect of enamel formation
- **Deciduous** & **permanent** teeth are involved
- **16** different hereditary subtypes exist with numerous **patterns of inheritance** {autosomal dominant, recessive or sex linked}

### I. Hypoplastic amelogenesis imperfecta

- ❖ **Defective organic matrix formation** {*quantitative defect*}
- ❖ Thickness of enamel is less than normal
- ❖ **Irregular** enamel, **pitted** or **thin**, **vertical grooves**
- ❖ Pits allow stains to accumulate causing discoloration



Calcification & maturation is normal

- Normal hardness & translucency
- Radiographically enamel shows normal radiopacity

## II. Hypocalcified amelogenesis imperfecta

- ❖ Normal quantity of enamel matrix
- Normal thickness of enamel in newly erupted teeth only



- ❖ Failure in normal calcification
- Enamel soft to probe abrades easily exposing the dentine to wear down rapidly to level of gum line {producing the characteristic shoulder form}
- The color varies from white opaque to yellow to brown
- Decreased radiopacity of enamel {indistinguishable from dentin}

## III. Hypomaturational amelogenesis imperfecta

- ❖ Normal enamel matrix which begins to mineralize
- Teeth are normal in shape & thickness
- ❖ The defect is in the maturation of the enamel's crystal structure
- Mottled, opaque, white-brown yellow discoloration
- Enamel is softer than normal, can be pierced by probe under pressure & attrition occurs but not as severely as in the hypocalcified type
- Radiodensity similar to dentine





## **Environmental factors affecting developing teeth**

### **A. Local factors**

1. Trauma    2. Infection

- ❖ Commonly seen in **permanent** teeth in which the overlying deciduous tooth becomes **abscessed** or **physically forced** into the enamel organ of the permanent tooth
- **Ameloblasts** overlying the developing crown are affected resulting in enamel *hypocalcification* or *hypoplasia*
- Affected tooth may have areas of coronal **discoloration** or **pits& irregularities**
- The resulting hypoplastic or hypocalcified permanent tooth is known as **{turner'tooth}**

### **B.S ystemic factors**

1. **Congenital syphilis**
2. Ingestion of chemicals { **fluorides** , **tetracycline** }
3. Exanthematous **fevers** { Scarlet fever , measles, chicken pox }
4. **Nutritional deficiency** { Vit .A , D , calcium, phosphorus }
5. **General diseases** ex. Rickets , Down syndrome  
Cleidocranial dysplasia

## **I-Congenital syphilis**

- ❖ Prenatal syphilis is due to **maternal infection**
- If the fetus is infected early , abortion occurs
- Later fetal infection results in infant born with **stigmata** or congenital syphilis
- ❖ The permanent teeth are affected
- **Because** spirochetes do not enter the circulation until the 16th week of intrauterine life {deciduous teeth has completely formed by the end of the 16th week}

**The dental stigmata of congenital syphilis is characterized by :**



**A. Mulberry molar:** the 1<sup>st</sup> molar may be domed shaped {**moon molar**}. Its occlusal surface exhibit multiple irregular tubercles replacing normal cusps



**B. Hutchinson teeth {upper incisors}**

1. **Barrel** shaped
2. Mesio & distal **convergence** in incisal half of teeth
3. Mesial & distal angles are **rounded**
4. **Notch** in the middle of incisor edge



## II-Tetracycline pigmentation

- Tetracycline binds to the calcifying tissue  
 —→ stains —→ the developing teeth & bone
- Tetracycline is deposited along the incremental lines of dentine & enamel —→ whole tooth may be discolored { bright yellow —→ dirty grayish brown }
- Affected teeth exhibit fluorescence under ultraviolet rays
- Tetracycline should not be prescribed during dental development { 4M-12y }



## III-Fluorosis {mottled enamel}

- Seen in people who grow up in areas where the *water supply contains a large amount of fluorides* **more than 1ppm**
- Overdose of fluorides interferes with the function of ameloblasts & calcification of the enamel matrix
- **Defect range** from *small white spots* to white *opaque areas* to *darkly stained* & *pitted* enamel
- The *extent of damage is dependent* on the **duration** **timing** & **concentration** of fluoride

To **differentiate** *between developmental & acquired alterations that may affect the tooth you must notice the following :*

### **Hereditary**

- Affect **both** *deciduous & permanent*
- Affect *either* the enamel or the dentine
- Produce **diffuse** or **vertically** oriented defects

### **Environmental**

- Affect **only** one dentition { **permanent** > deciduous }
- Affects **both** enamel & dentine
- Produce **horizontal** oriented defects

### **Developmental alterations in the *dentine* of the tooth**

1. Dentinogenesis imperfecta
2. Dentinal dysplasia { rootless teeth }
3. Regional odontodysplasia { ghost cell }
4. Shellteeth

## 1. Dentinogenesis imperfecta

- ❖ Uncommon defect of collagen formation transmitted as an **autosomal dominant trait**
- Both dentition are affected
- Dentin is soft and has an abnormal high water content
- Appears *alone* or *associated with osteogenesis imperfecta*

### Teeth affected show

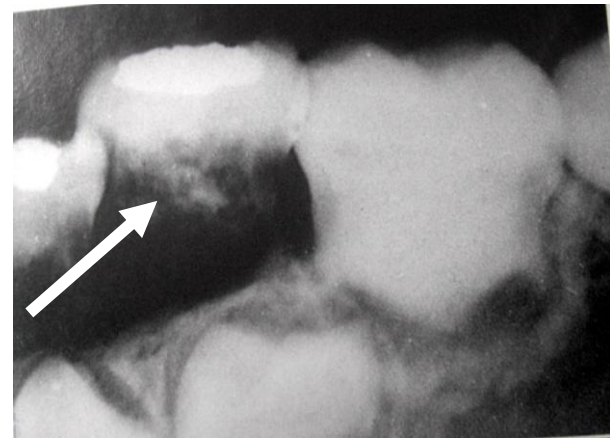
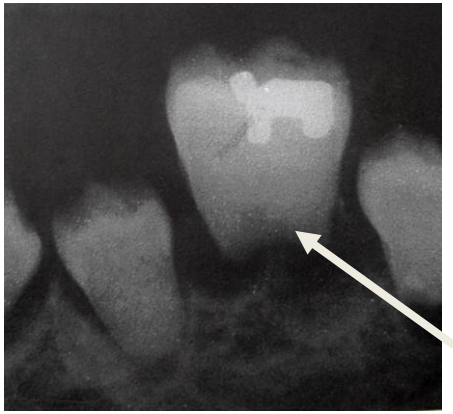
1. Tooth crown shows amber coloration { blue brown } or opalescent
2. Bulbous crown & short roots



3. Absence of scalloping between enamel and dentine  
 → flat ADJ → union between enamel and dentine is defective → enamel chips away → soft dentine will be exposed → rapidly wear off  
worn down to gum level by adolescence

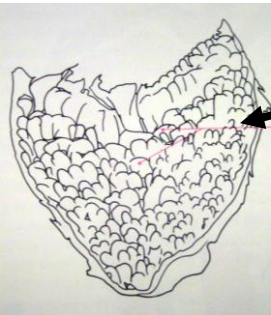
4. Pulp chamber is obliterated by continuous formation of the imperfect dentine





## 2. Dentine dysplasia {rootless teeth}

- Characterized by teeth with very short roots
- Obliteration of the pulp chamber by fused rounded nodules of poorly formed dentine



- ❖ The teeth are typically lost early in life because of
  - the weak support given by the short roots or
  - periapical inflammatory lesions

## 3. Regional odontodysplasia {ghost teeth}

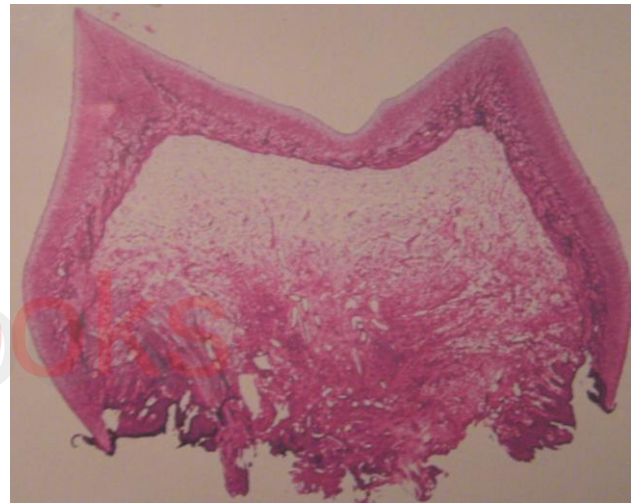


- Unknown cause
- Involves **deficiencies** of all the hard tissues of the teeth {enamel ,dentine &cementum}
- Tissues are thin, poorly mineralized & are described as ghost teeth radiographically
- The poor quality of the affected teeth make them of little use



#### **4.Shell teeth**

- ❖ Variant of dentinogenesis imperfecta
- ❖ Transmitted through the same gene
- **Excessively large pulp chamber**
- After the formation of a thin layer of dentine the formation of dentine ceases & results in a very large pulp chamber surrounded by a **thin shell of dentine**
- **Enamel is normal**



**Normal pulp**



**Excessively large pulp chamber**

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